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(54) **CELL CONNECTOR HAVING VOLTAGE TAPPING POINT COATED WITH CONTACTING MATERIAL**

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H01M 2/30	(2006.01)
H01R 12/59	(2011.01)
H01R 13/03	(2006.01)
H01R 43/16	(2006.01)

(52) **U.S. Cl.**

CPC ***H01M 2/202*** (2013.01); *H01R 12/592* (2013.01); *H01R 13/03* (2013.01); *H01R 43/16* (2013.01); *Y10T 29/49224* (2015.01)

(58) **Field of Classification Search**

CPC H01M 2/202; H01R 12/592; H01R 13/03; H01R 43/16; Y10T 29/49224
USPC 429/158; 29/885
See application file for complete search history.

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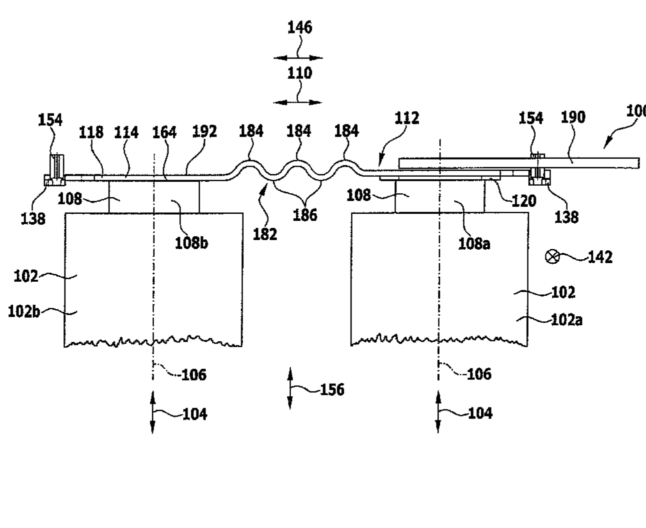
(57) **ABSTRACT**

A cell connector is provided by means of which an electrically conductive connection between a voltage tapping point and a voltage tapping line can be established, wherein the cell connector is for the connection of a first cell terminal of a first electro-chemical cell and a second cell terminal of a second electro-chemical cell and includes a voltage tapping point with a contact element for connection to a terminal element of a voltage tapping line and also a longitudinal axis and a peripheral wall extending about the longitudinal axis. The contact element includes a base material, which is at least partially pre-coated with a contacting material in an initial state, and reshaped from the initial state into a final state such that the proportion of the peripheral wall coated with the contacting material to the overall peripheral angular extent of the peripheral wall amounts to more than 50%.

13 Claims, 19 Drawing Sheets



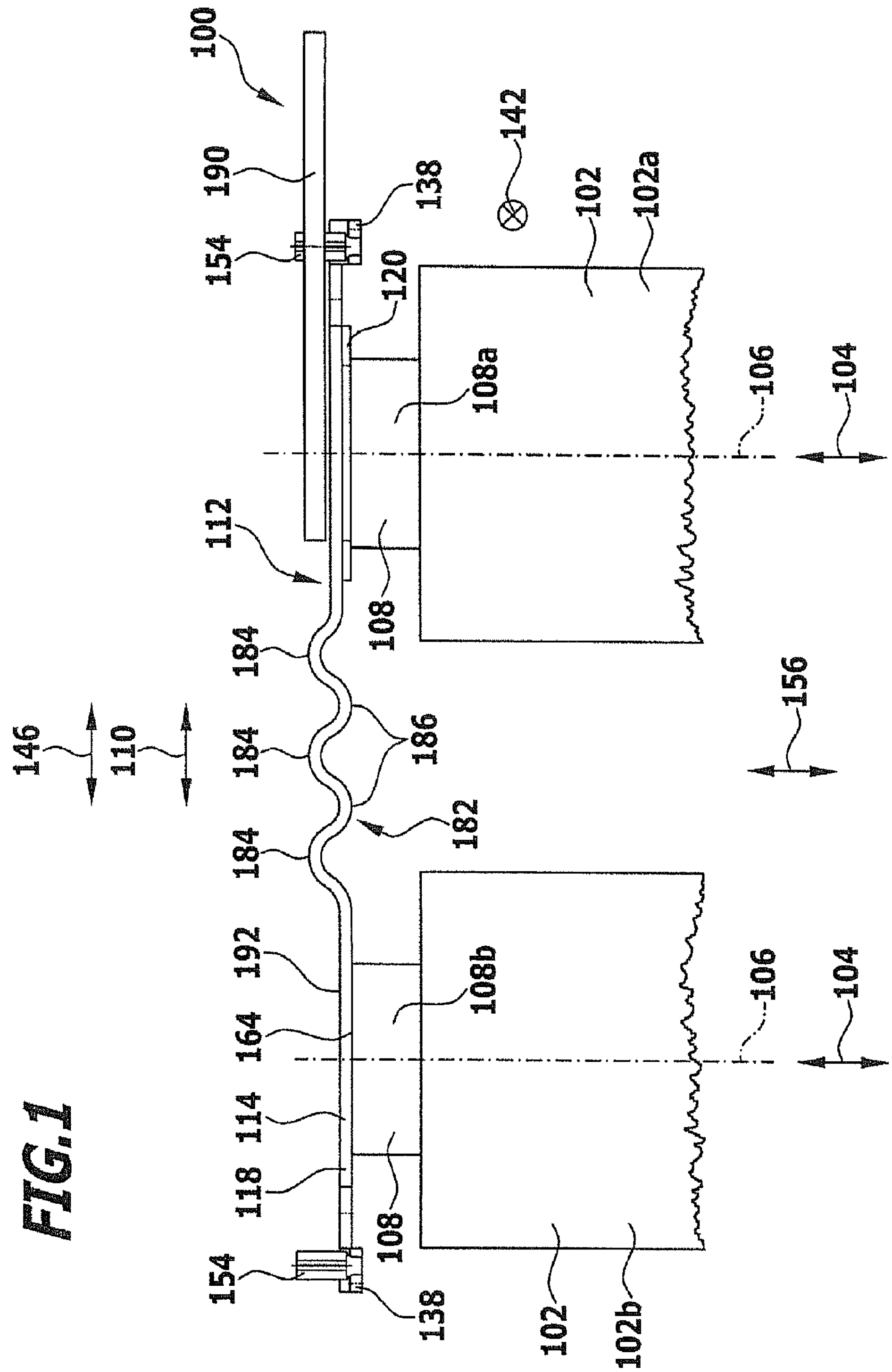

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FIG. 1

FIG. 2

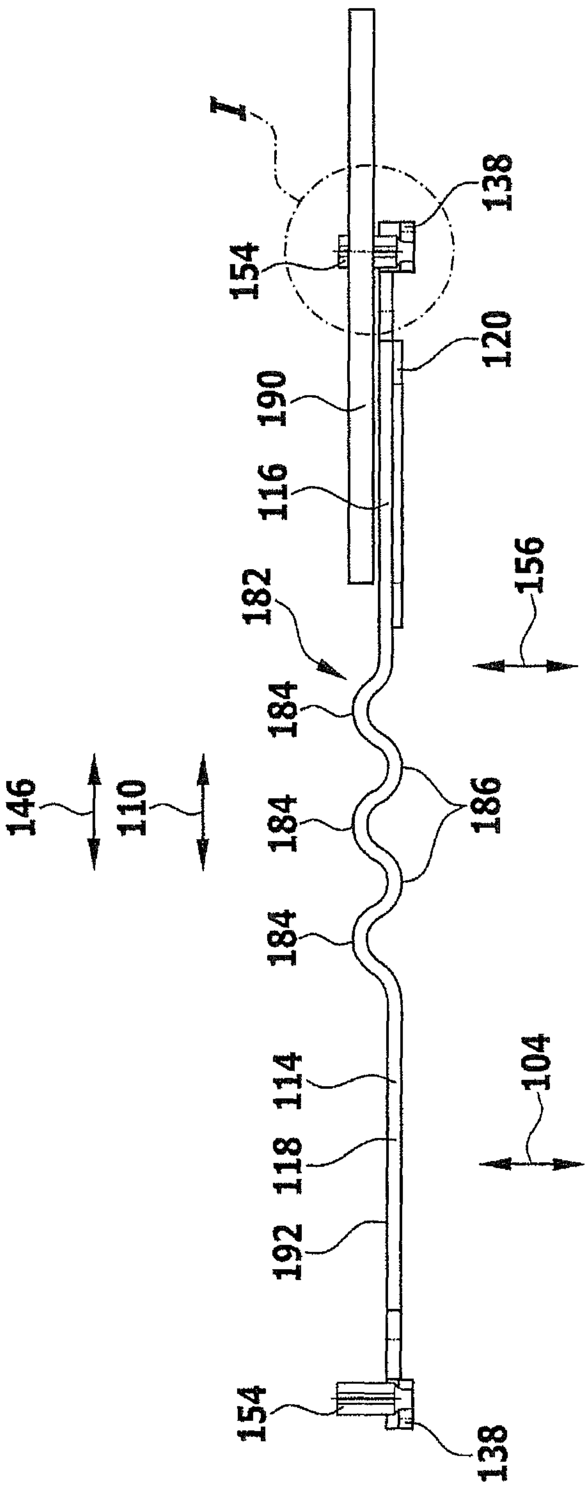
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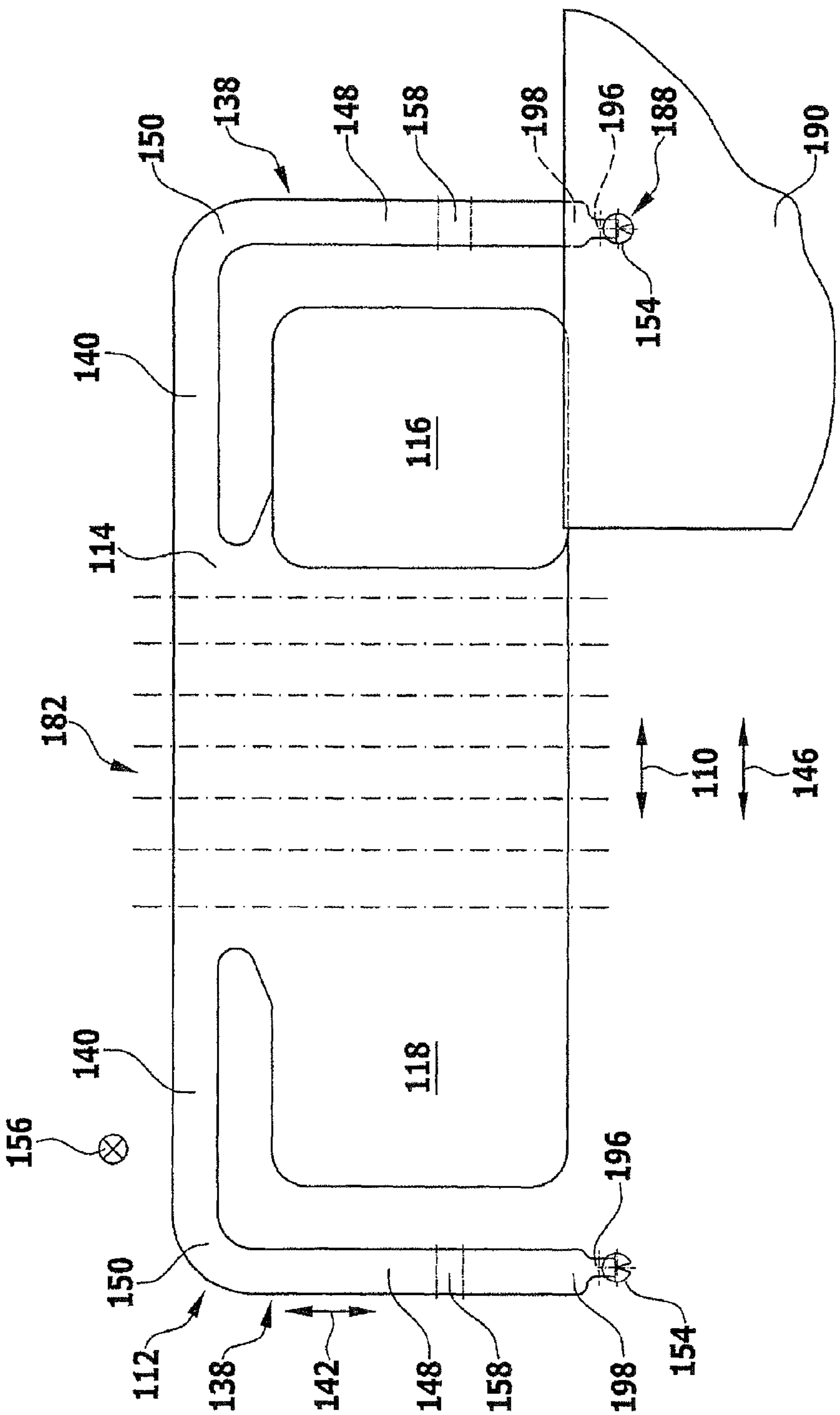
FIG.3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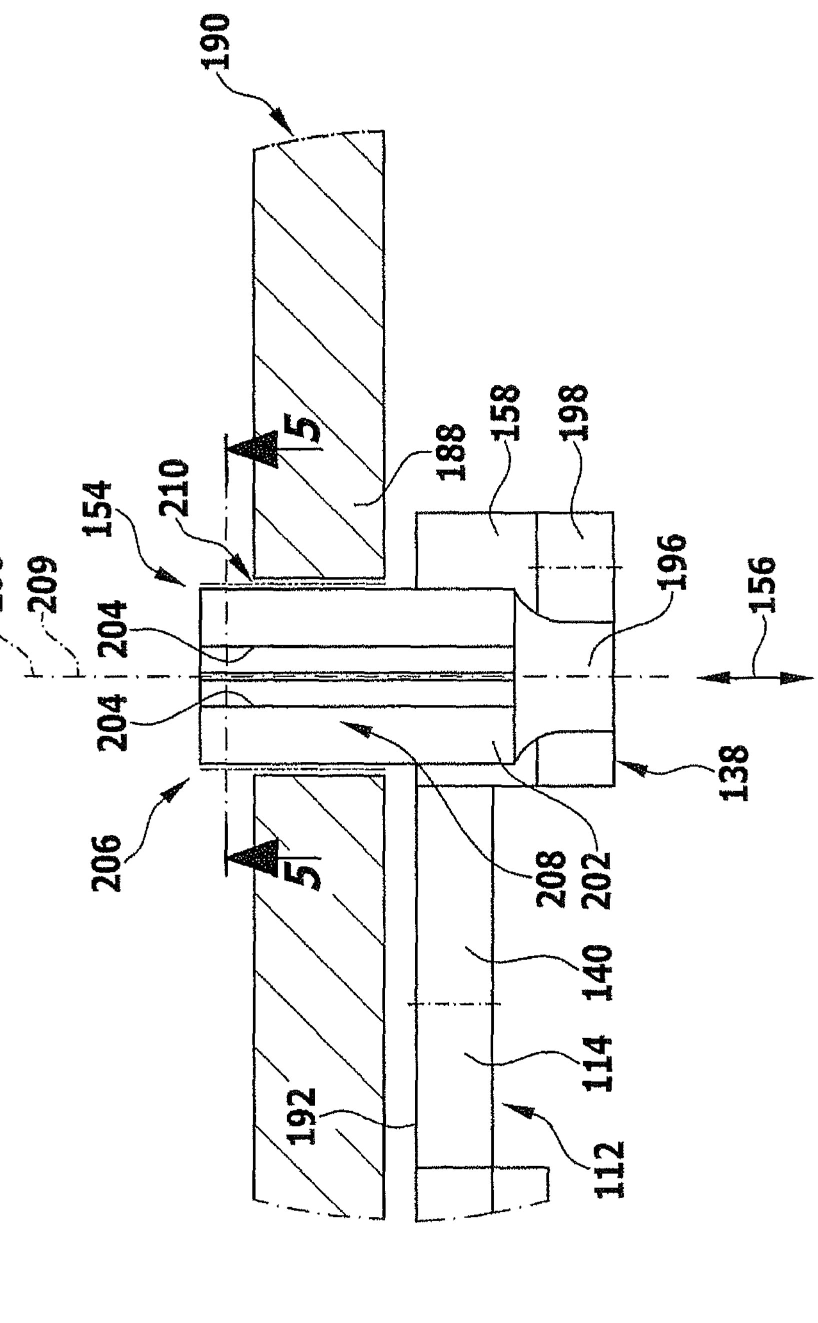
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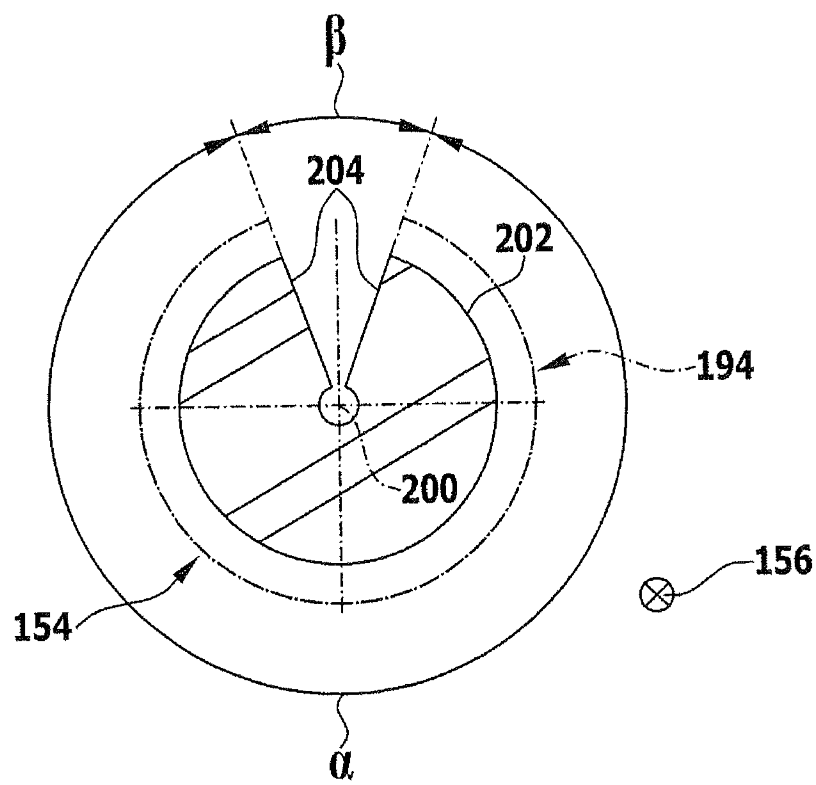
FIG.4

FIG.5



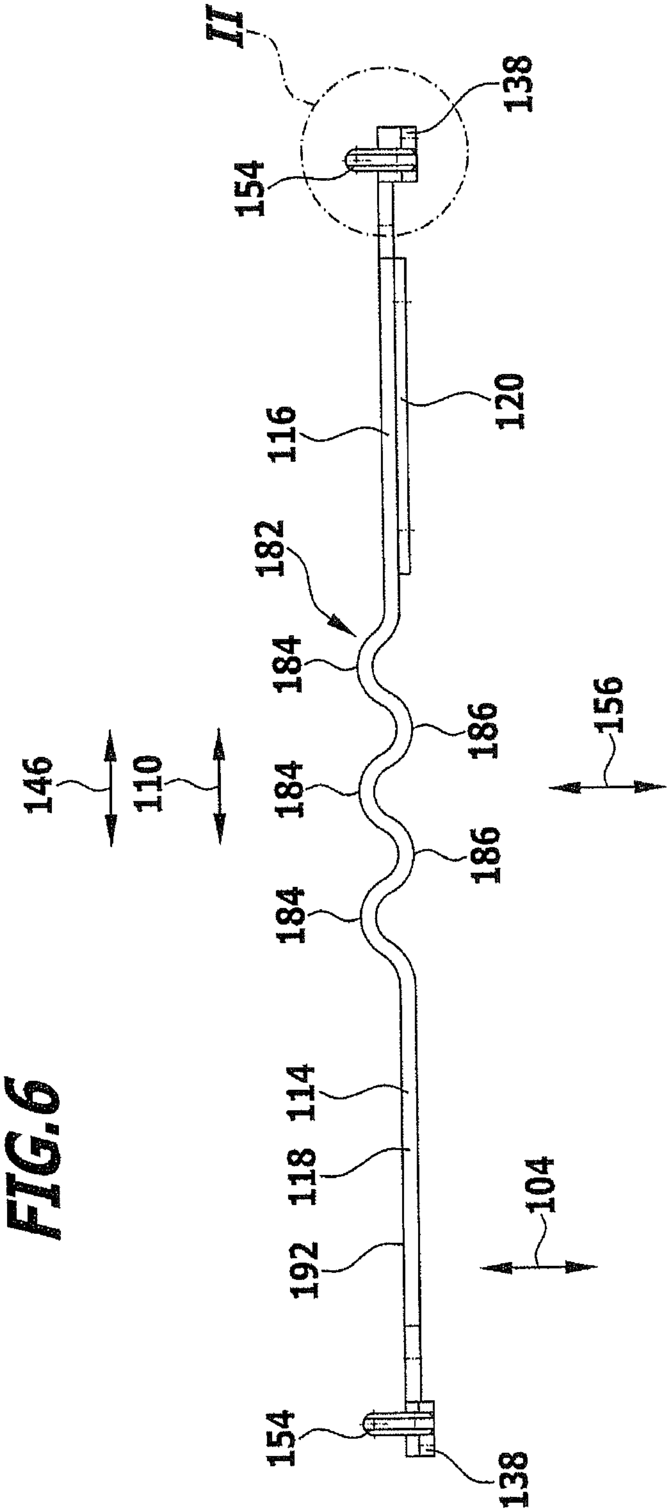

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FIG.6

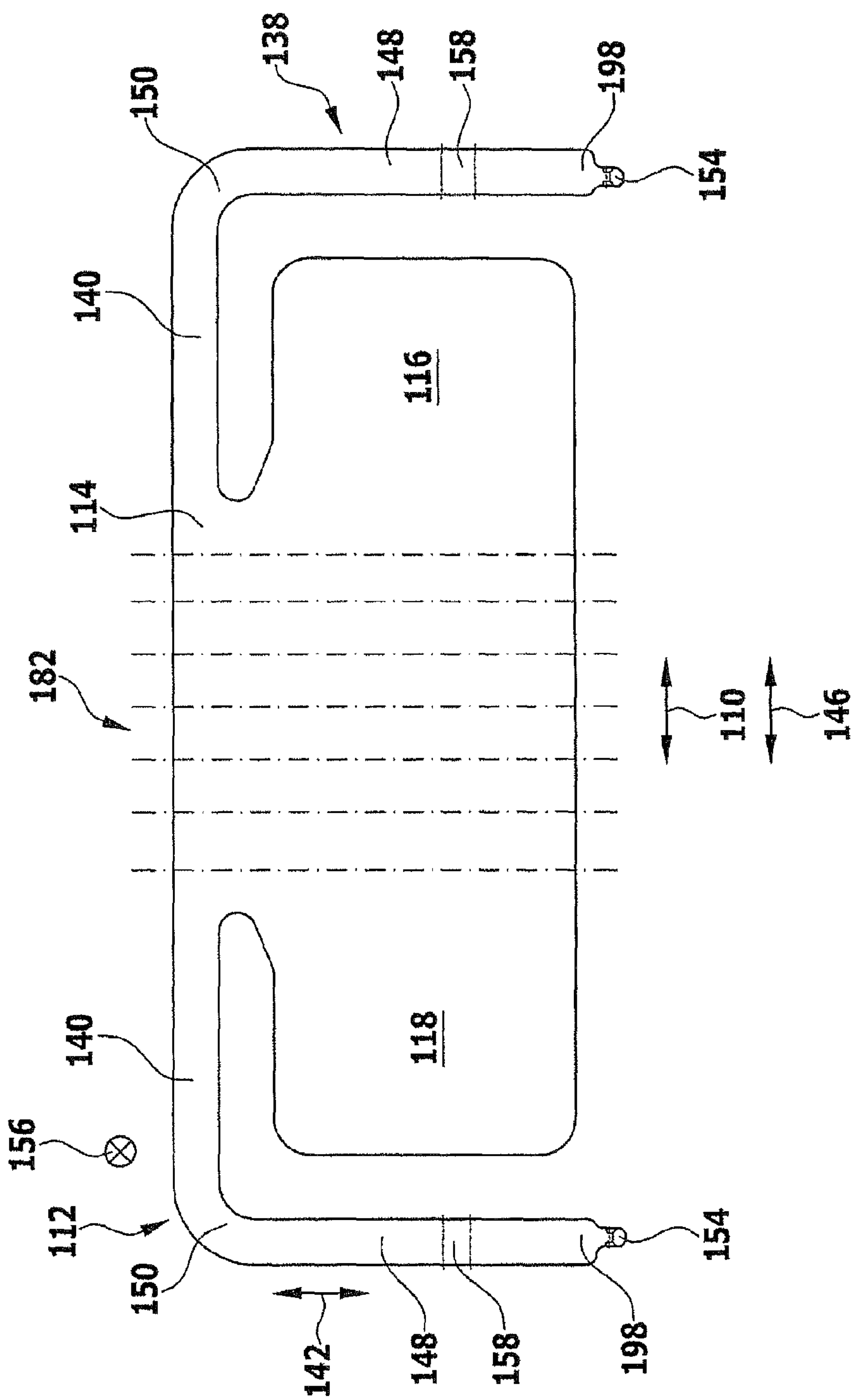
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FIG.7

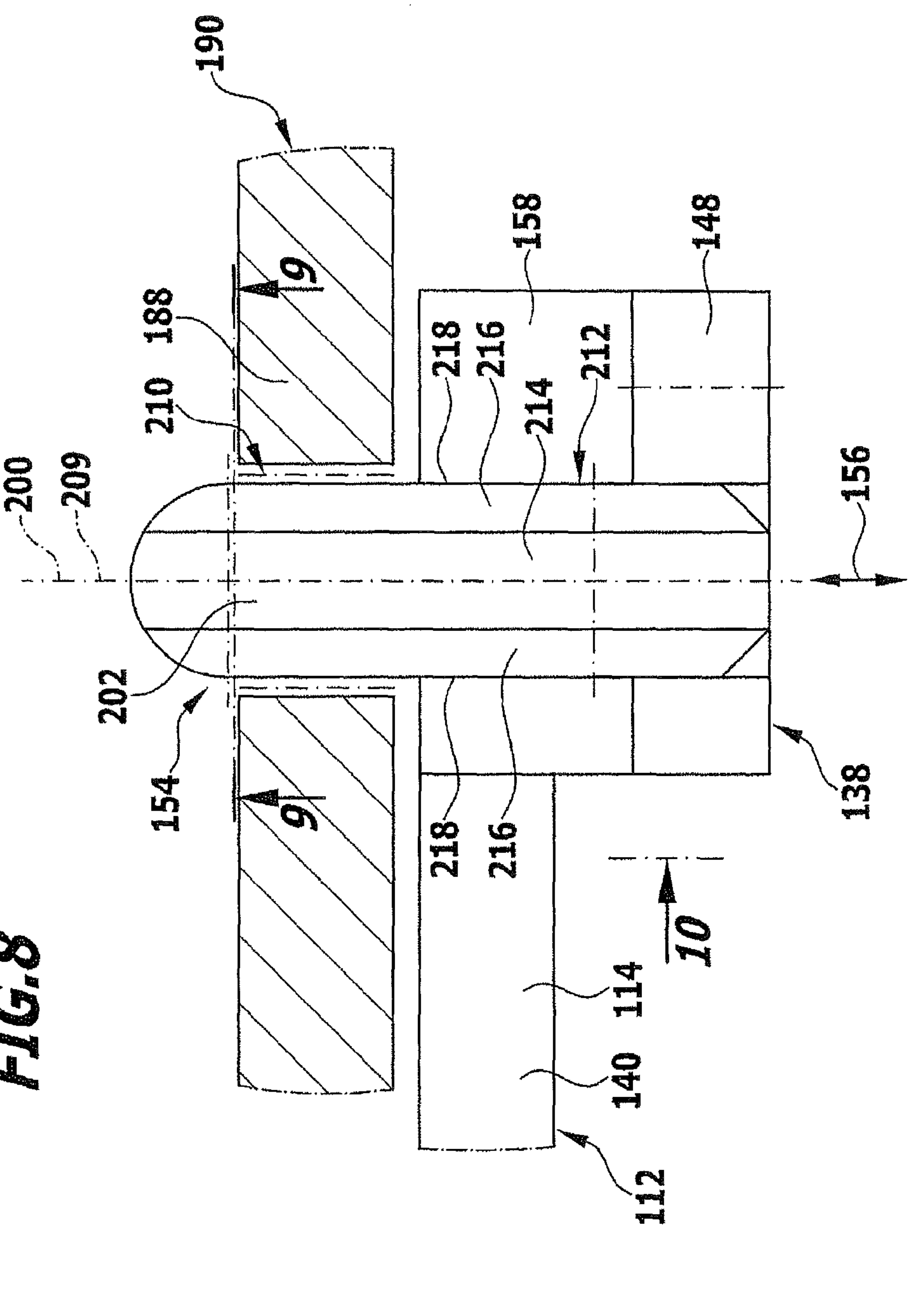
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FIG.8

FIG.9

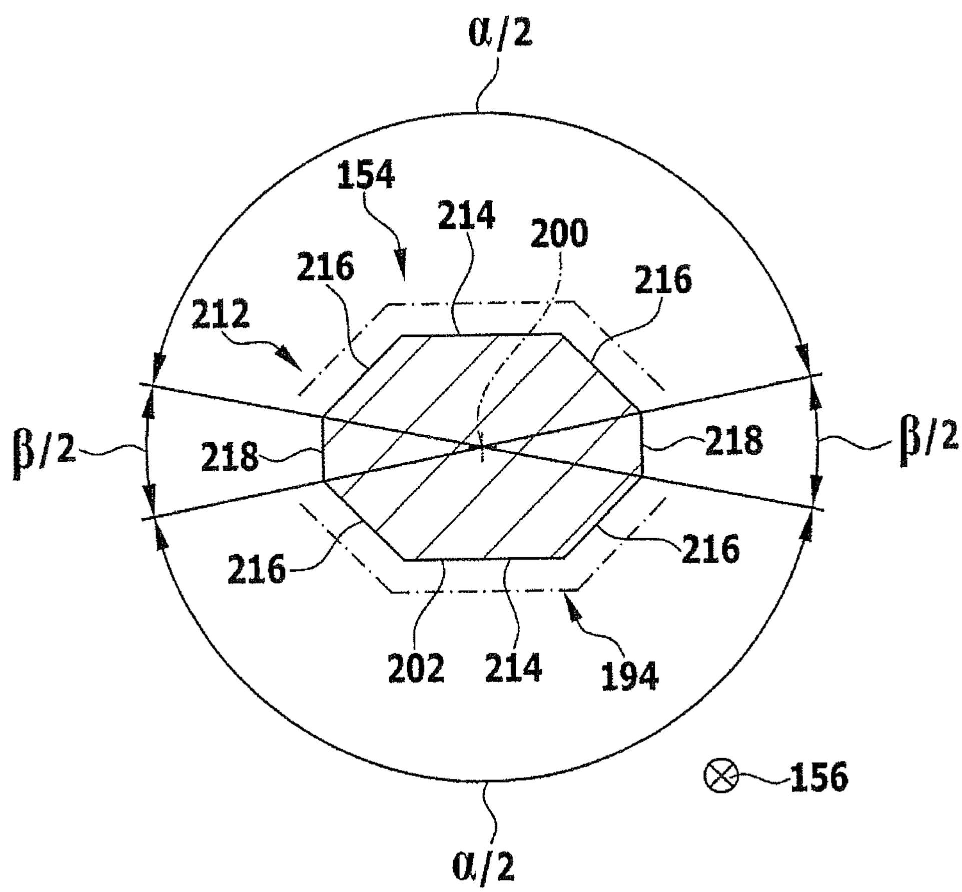
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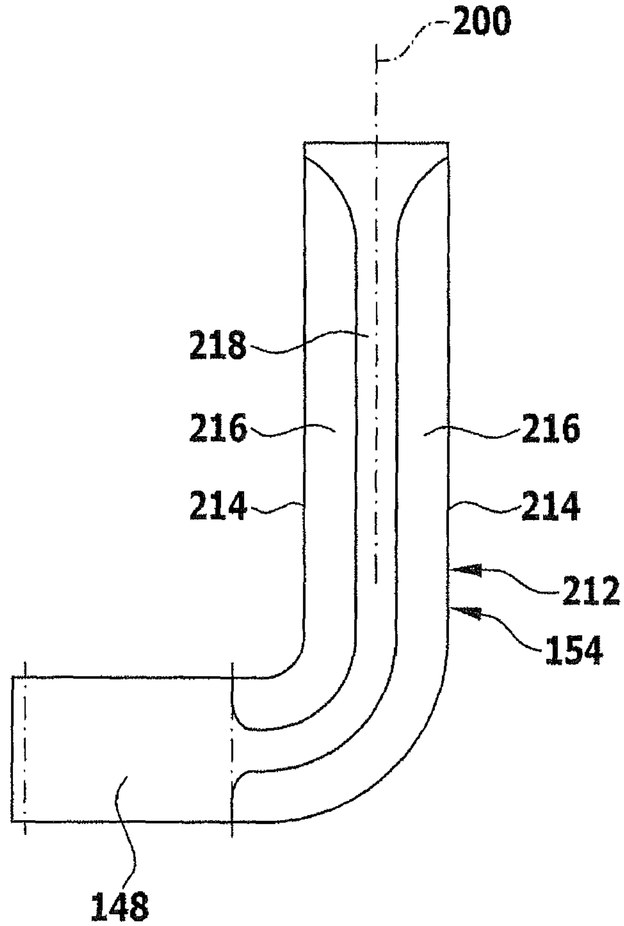
FIG.10



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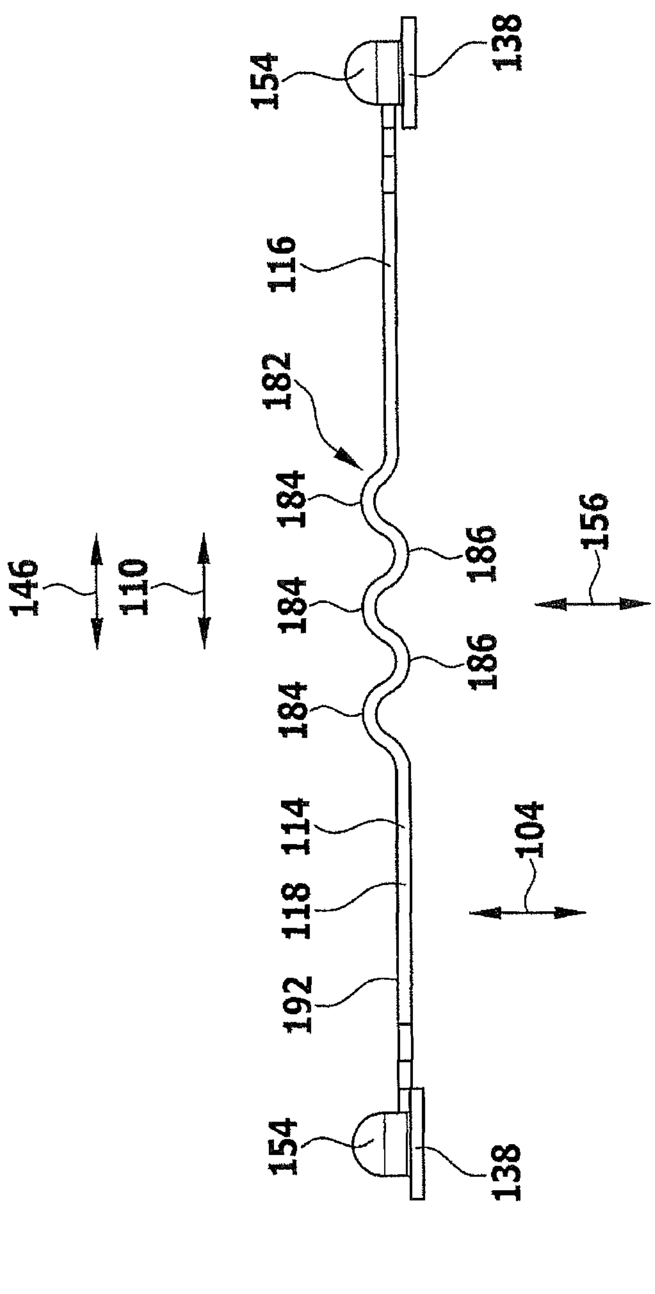
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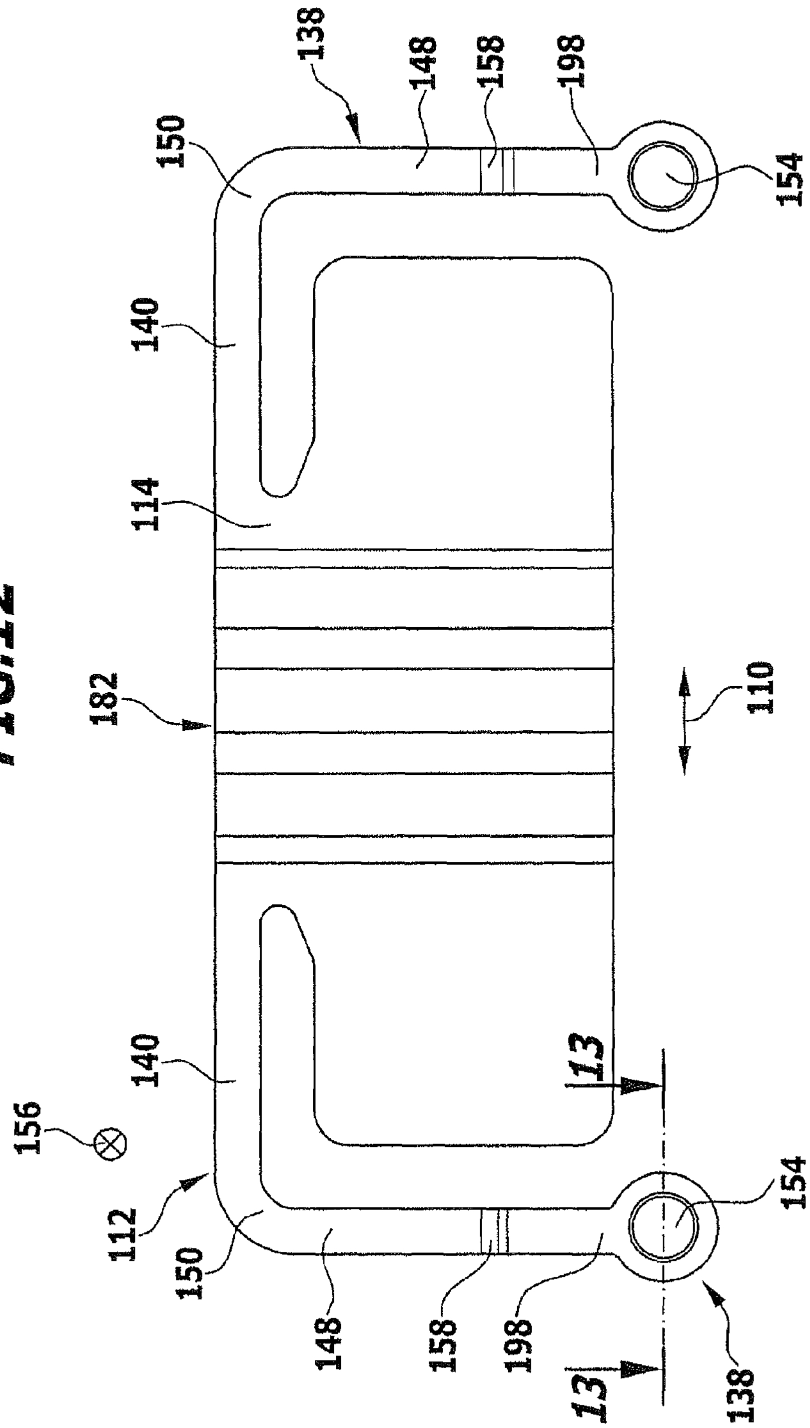
FIG.12



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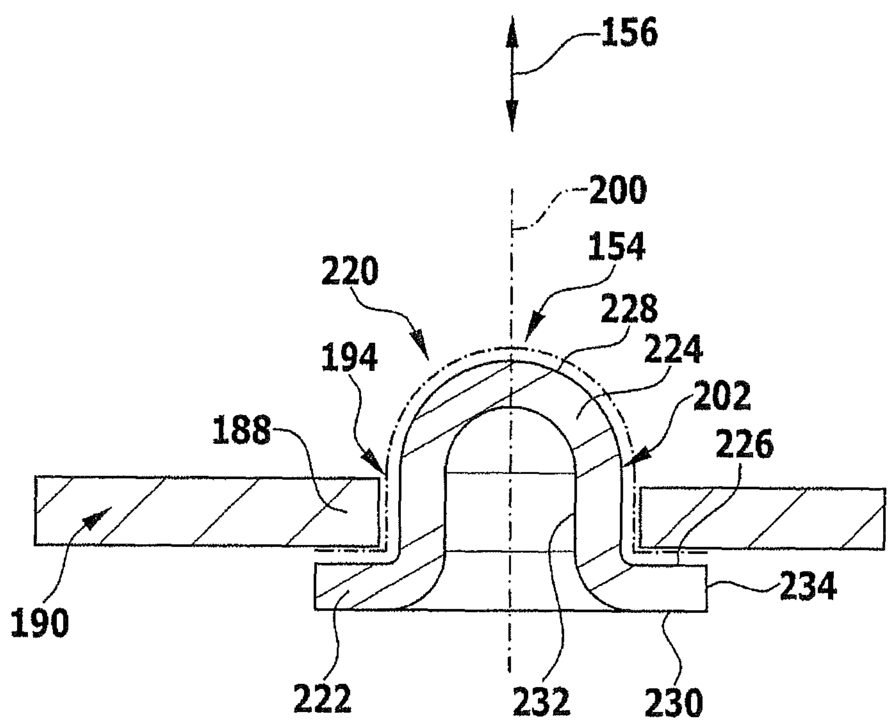

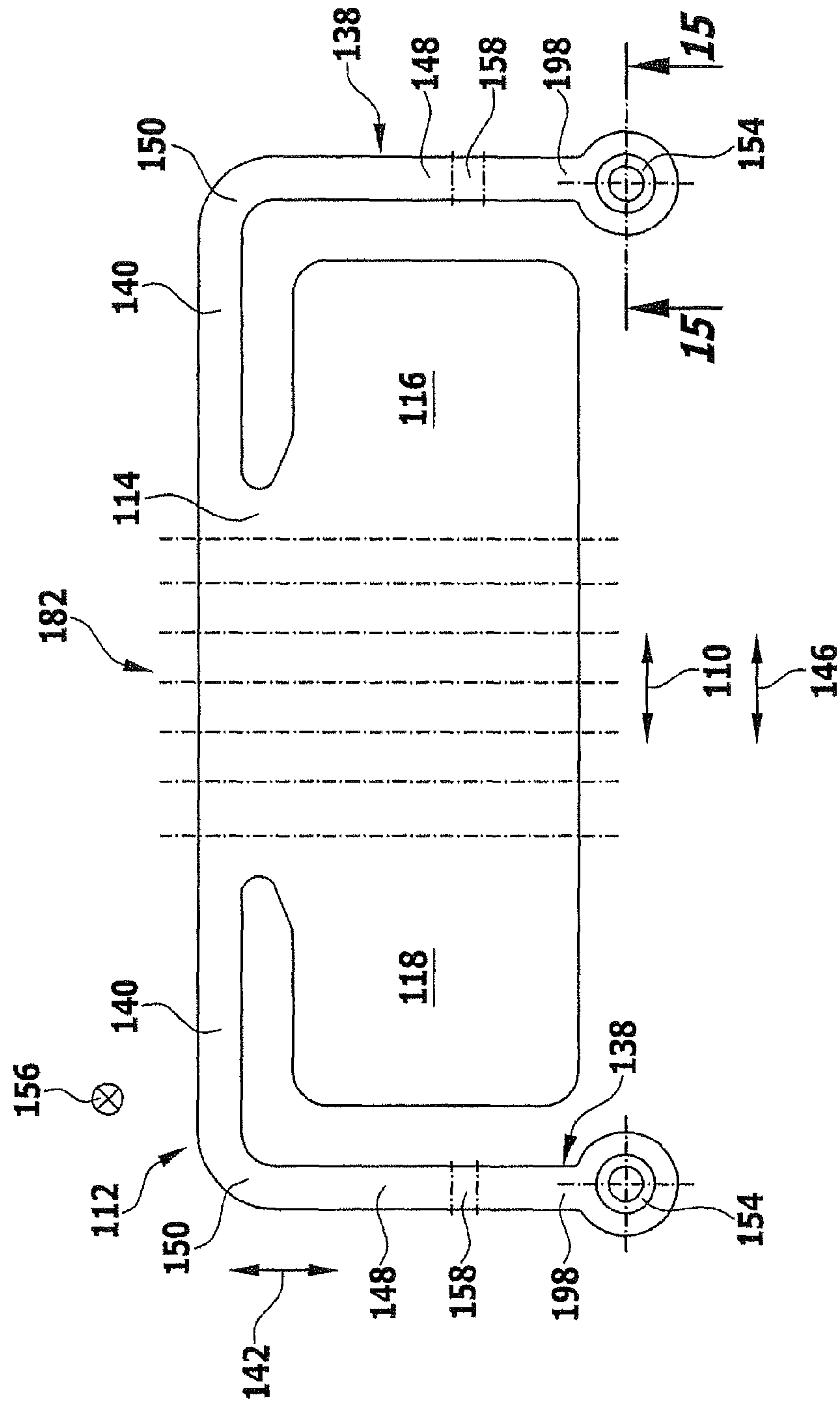
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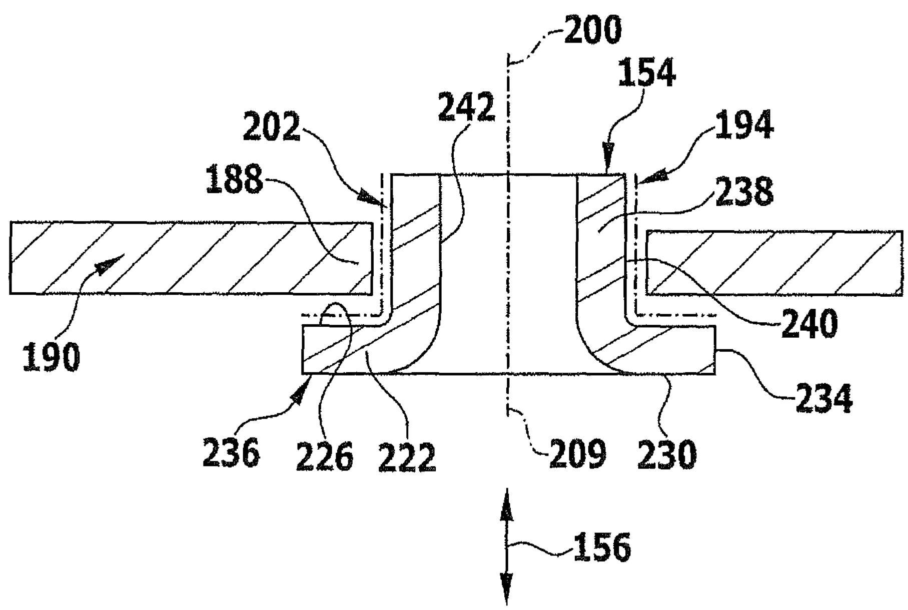
FIG.14

FIG.15



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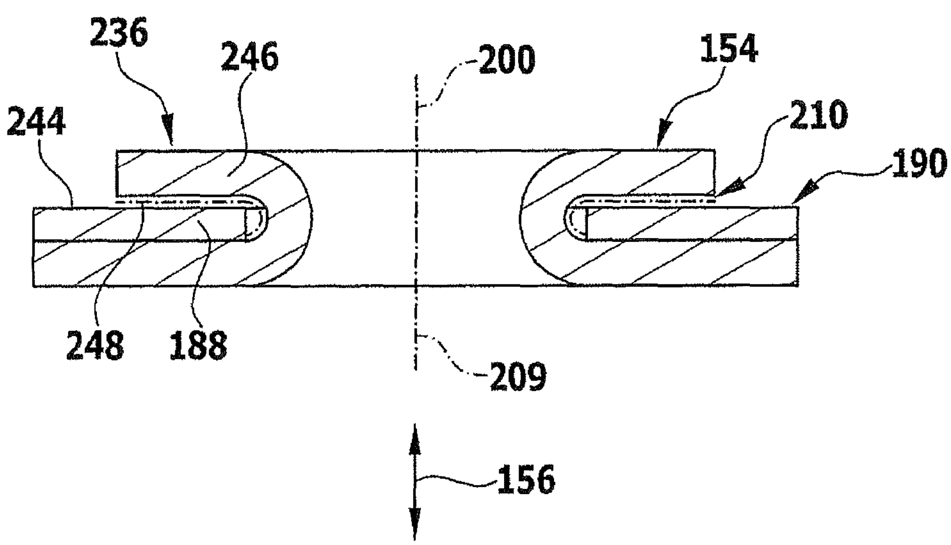

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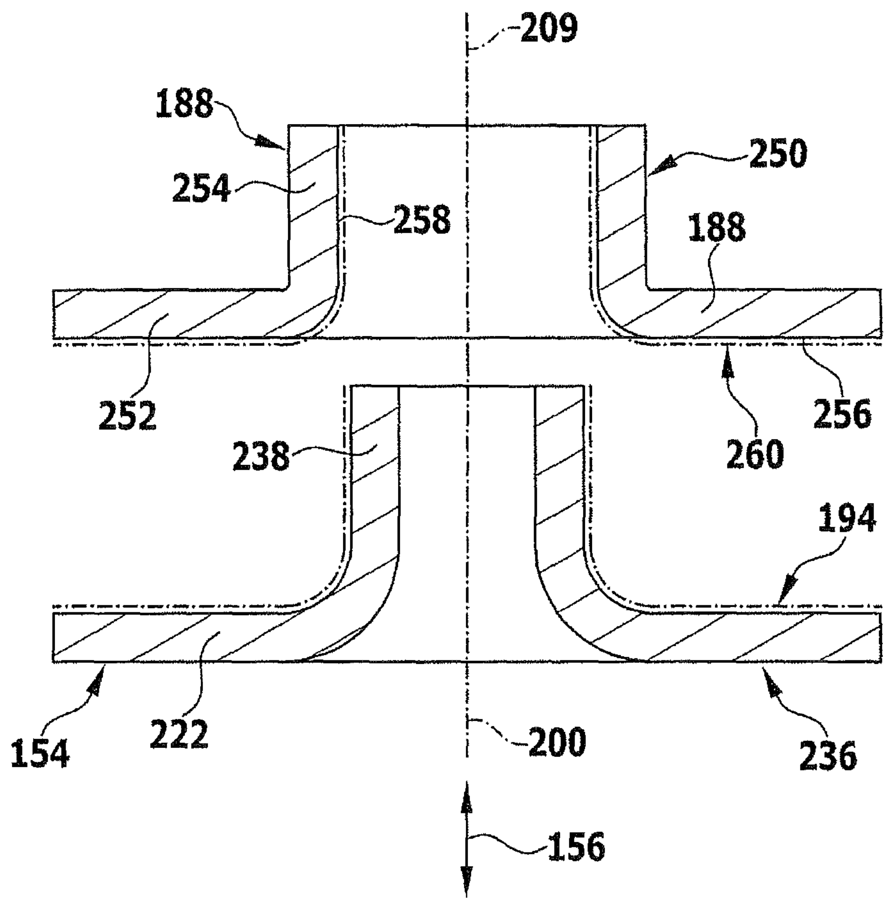


FIG.18

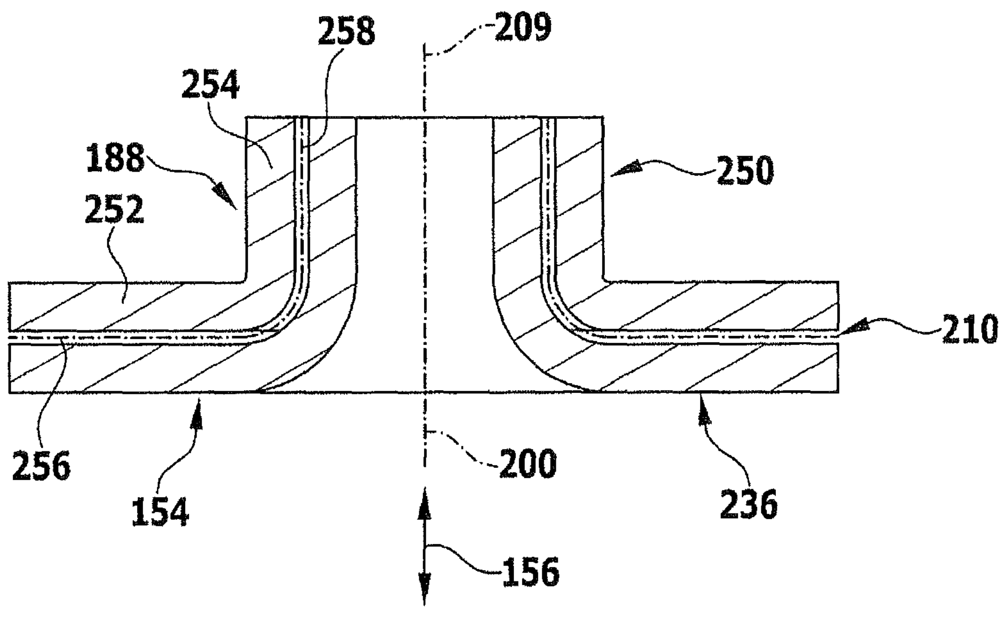
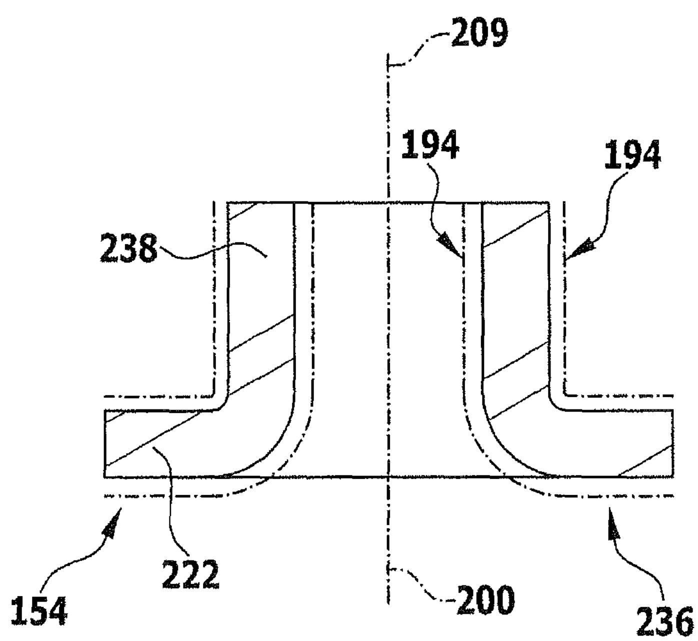


FIG.19



CELL CONNECTOR HAVING VOLTAGE TAPPING POINT COATED WITH CONTACTING MATERIAL

CROSS REFERENCE TO RELATED APPLICATION

The present disclosure claims priority from, and the benefit under 35 U.S.C. §119, of German Patent Application No. 10 2012 202 623.1, filed Feb. 21, 2012, the entire specification of which is incorporated herein by reference.

FIELD OF DISCLOSURE

The present invention relates to a cell connector for the electrically conductive connection of a first cell terminal of a first electro-chemical cell to a second cell terminal of a second electro-chemical cell, wherein the cell connector comprises a voltage tapping point having a contact element for electrically conductive connection to a terminal element of a voltage tapping line and wherein the contact element comprises a longitudinal axis and a peripheral wall extending around the longitudinal axis.

Such electro-chemical devices can be in the form of electrical accumulators, particularly in the form of lithium ion accumulators for example.

BACKGROUND OF THE INVENTION

In the case of a lithium ion accumulator, the voltage difference between the two cell terminals (poles) of an individual accumulator cell amounts to approximately 3.6 V. In order to obtain the requisite higher voltage level of e.g. approximately 360 V that is needed for many applications such as in the field of automobile propulsion for example, many such accumulator cells (approximately 100 for example) have to be connected electrically in series.

In connection therewith, the accumulator cells or, more generally, the electro-chemical cells can be combined into modules each of which contains a plurality of such electro-chemical cells, wherein the direction in which the mutually neighboring cells are installed alternates so that positive and negative cell terminals are located next to each other in alternating manner. These mutually neighboring cell terminals of opposite polarity are interconnected directly by means of a cell connector for producing the series connection of the cells.

The voltage tapping point incorporating the contact element connected to a base body of the cell connector serves to provide a reliable, operationally secure, low contact resistance connection of the cell connector to a voltage tapping line which itself is connected to an evaluating device of the electro-chemical device.

Differences in electrical potential between the various cell connectors are measured by the evaluating device in order to facilitate monitoring of each individual cell in the electro-chemical device.

SUMMARY OF THE INVENTION

The object of the present invention is to enable the electrically conductive connection between the voltage tapping point and the voltage tapping line to be produced in a particularly simple and reliable manner.

In accordance with the invention, this object is achieved in the case of a cell connector incorporating the features indicated in the first part of claim **1** in that the contact element comprises a base material which is at least partially pre-

coated with a contacting material in an initial state and is reshaped from the initial state into a final state in such a manner that the proportion of the part of the peripheral wall that is coated with the contacting material amounts to more than 50% of the overall peripheral angular extent of the peripheral wall.

Due to the construction of the contact element in accordance with the invention, it is possible to produce a reliable, electrically conductive solder joint between the contact element of the voltage tapping point and the terminal element of the voltage tapping line even if the base material of the contact element is non-solderable or can only be soldered with difficulty.

Aluminum or aluminum alloys in particular cannot be soldered without special measures and in particular, without a pre-coating, because of the oxide coating that is always present on the surface thereof.

Cell connectors however are frequently manufactured from an aluminum-containing material in order to enable the cell connector to be connected to a likewise aluminum-containing cell terminal uniformly by means of a substance-to-substance bond.

In order to obtain a solderable surface in the case of a contact element consisting of an intrinsically non-solderable base material, the base material is pre-coated with a solderable contacting material.

In connection therewith, in the region from which the contact element is formed, the base material may be only partially pre-coated with the contacting material or it could be pre-coated over substantially the whole of its surface area.

In particular, a partial pre-coating can be applied to the base material in the form of strips.

In the case of an only partially pre-coated base material, provision may be made in particular for at least one contact region at which the cell connector is connected to a cell terminal in the assembled state, to remain free of the pre-coating incorporating the contacting material so that a cell connector consisting of a material matching the material of the cell terminal can be connected, by welding for example, uniformly to the cell terminal.

In the case of contact elements punched out from a starting material, it is normally necessary to also apply a coating incorporating a contacting material to the punched edges in an additional processing step in order to obtain a sufficiently large solderable surface on the contact element.

Thus, for example, the cross section of a square soldering pin having a material thickness of 1 mm and a width of 1 mm has a 50% portion of rolled sheet metal surface and another 50% portion consisting of a punched edge. If, here, one makes use of a pre-coated tape-like material, this then results in the proportion of coated surface being just 50%. However, in order to ensure secure soldering of the surface of the soldering pin, such a proportion of coated surface is not sufficient; it would therefore be necessary to coat the entire surface area of such a pin in an additional processing step.

Due to the solution in accordance with the invention, such a complex and expensive additional processing step is saved.

Namely, in accordance with the invention, the base material that is pre-coated with a contacting material in an initial state thereof is reshaped from the initial state into a final state in such a manner that the proportion of the part of the peripheral wall of the contact element that is coated with the contacting material to the overall peripheral angular extent of the peripheral wall amounts to more than 50%.

Consequently, due to the enlargement of the proportion of the part of the peripheral wall that is coated with the contacting material and is therefore solderable to the peripheral angular extent of the contact element, one obtains the effect that the contact element is solderable, and in particular, that it is solderable to a terminal element of a voltage tapping line on a printed circuit board without an additional coating step being required for this purpose.

In a preferred embodiment of the invention, the pre-coated base material is reshaped in such a manner that, in the final state, the proportion of the part of the peripheral wall that is coated with the contacting material to the overall peripheral angular extent of the peripheral wall amounts to more than 60%, and preferably, to more than 75%.

For the purposes of obtaining a secure connection between the contact element and the terminal element, it is particularly expedient if, in the final state, the peripheral wall of the contact element is coated with the contacting material over a peripheral angular extent of at least approximately 270°, preferably of at least approximately 300°.

In connection therewith, the peripheral angular extent is taken with reference to the longitudinal axis of the contact element.

In special embodiments of the cell connector in accordance with the invention, the contact element is formed such as to be substantially rotationally symmetrical with respect to the longitudinal axis.

The contact element can, for example, be in the form of a pin which is coated with the contacting material on the outer periphery thereof.

As an alternative thereto, provision may also be made for the contact element to be in the form of a sleeve which is coated with the contacting material on the inner periphery thereof and/or on the outer periphery thereof.

The contact element can, for example, be reshaped from the initial state into the final state by a rolling process, by a deep-drawing process and/or by a stamping process.

In a preferred embodiment of the invention, provision may be made for the base material of the contact element to comprise aluminum.

It is particularly expedient if aluminum forms the main component of the base material, i.e. that component which comprises the highest part by weight of the base material.

Preferably, the base material is aluminum or an aluminum alloy.

The contacting material is electrically conductive and preferably a metallic material.

Preferably, the contacting material comprises nickel, silver, gold, copper and/or tin.

It is particularly expedient, if nickel, silver, gold, copper or tin form the main component of the contacting material, i.e. that component comprising the highest part by weight of the contacting material.

In particular, provision may be made for the contacting material to be a nickel alloy, a silver alloy, a gold alloy, a copper alloy or a tin alloy.

The contact element may comprise at least one free separation edge, in particular a free punched edge or a free cut edge, that is not coated with the contacting material.

In accordance with the invention, the proportion of the free separation edge that is not coated with the contacting material to the overall peripheral angular extent of the peripheral wall is less than 50%, preferably less than 40%, and in particular, less than 25%.

It is particularly expedient, if, in the final state of the contact element, at least one peripheral wall of the contact element is coated with the contacting material to at least 50%, preferably to at least 60%, in particular to at least 75%, and most preferably, substantially completely.

The cell connector in accordance with the invention is suitable in particular for use in a combination of such a cell connector and a terminal element of a voltage tapping line of an electro-chemical device, wherein the contact element of the cell connector is connected to the terminal element by means of a substance-to-substance bond.

In connection therewith, the contact element can be soldered in particular to the terminal element.

Furthermore, provision may be made for the terminal element to comprise a passage opening with an axial direction, wherein the longitudinal axis of the contact element is oriented such as to be substantially coaxial with the axial direction of the passage opening.

The electro-chemical device in which the cell connector is employed, can, in particular, be in the form of an accumulator, a lithium ion accumulator for example.

If the electro-chemical device in accordance with the invention is in the form of an accumulator, then it is suitable in particular as a high capacity energy source for motor vehicle drives for example.

Furthermore, the present invention relates to a method of manufacturing a cell connector for connecting a first cell terminal of a first electro-chemical cell and a second cell terminal of a second electro-chemical cell in electrically conductive manner, wherein the cell connector comprises a voltage tapping point having a contact element for the electrically conductive connection thereof to a terminal element of a voltage tapping line.

The further object of the present invention is to provide such a method by means of which there is manufactured a cell connector, the contact element of which is connectable electrically in highly conductive manner to the terminal element of the voltage tapping line in a particularly simple manner.

In accordance with the invention, this object is achieved by a method for manufacturing a cell connector which comprises the following processing steps:

- providing a base material which is at least partially pre-coated with a contacting material;
- separating out a cell connector pre-form from the pre-coated base material;
- reshaping the cell connector pre-form in such a way that a contact element is formed which, in the final state after the reshaping process, has a longitudinal axis and a peripheral wall extending over a peripheral angular extent about the longitudinal axis, wherein, in the final state, the proportion of the part of the peripheral wall that is coated with the contacting material to the overall peripheral angular extent of the peripheral wall amounts to more than 50%, preferably more than 60%, and in particular, to more than 75%.

In particular, provision may be made for the proportion of the part of the peripheral wall that is coated with the contacting material to the overall peripheral angular extent of the peripheral wall to amount to substantially 100% in the final state.

The method in accordance with the invention for manufacturing a cell connector can, in particular, form a part of a method of producing an electrically conductive connection between the cell connector and a terminal element of a voltage tapping line of an electro-chemical device which comprises the following additional processing step:

- connecting the contact element of the cell connector to the terminal element by a substance-to-substance bond, in particular by soldering.

Particular embodiments of the method in accordance with the invention have already been described hereinabove in the context of the cell connector in accordance with the invention.

The concept underlying the present invention is that, for the purposes of forming the contact element, use is made of a pre-coated base material and this is then reshaped, in particular, by processes integrated into a follow-on tool, such as rolling, stamping or deep-drawing for example, in such a manner that a contact element having a sufficiently large, coated surface thereby results.

The enlargement of the peripheral angular extent of the solderable surface of the contact element can, for example, be effected by a cold-flow beveling process, by rolling a pin or by deep-drawing a soldering land, an eyelet or a bowl.

Due to this reshaping process, a pre-coated base material, a strip-coated aluminum material for example, can be employed and soldered without involving further coating processes thereby producing significant savings in materials and work.

Further features and advantages of the invention form the subject matter of the following description and the graphical illustration of exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a schematic side view of a cell connector and two electro-chemical cells in which the cell terminals thereof are connected together by means of the cell connector;

FIG. **2** shows a schematic side view of the cell connector depicted in FIG. **1**, without the electro-chemical cells being connected together by the cell connector;

FIG. **3** shows a schematic plan view from above of the cell connector depicted in FIGS. **1** and **2** and a printed circuit board to which a voltage tapping point of the cell connector is connected;

FIG. **4** shows an enlarged, partially sectional view of the region I depicted in FIG. **2**;

FIG. **5** shows a schematic cross section through a contact element of the voltage tapping point, along the line **5-5** in FIG. **4**;

FIG. **6** shows a schematic side view of a second embodiment of a cell connector having a contact element which comprises bevels produced by a cold-flow pressing process;

FIG. **7** shows a schematic plan view from above of the cell connector depicted in FIG. **6**;

FIG. **8** shows an enlarged, partially sectional illustration of the region II depicted in FIG. **6**;

FIG. **9** shows a schematic cross section through the contact element of the cell connector, along the line **9-9** in FIG. **8**;

FIG. **10** shows a schematic side view of the contact element depicted in FIG. **8**, along the line of sight denoted by the direction of the arrow **10** in FIG. **8**;

FIG. **11** shows a schematic side view of a third embodiment of a cell connector incorporating a contact element which is in the form of a deep-drawn bowl;

FIG. **12** shows a schematic plan view from above of the cell connector depicted in FIG. **11**;

FIG. **13** shows a schematic vertical section through the contact element of the cell connector depicted in FIGS. **11** and **12**, along the line **13-13** in FIG. **12**;

FIG. **14** shows a schematic plan view from above of a fourth embodiment of a cell connector incorporating a contact element which is in the form of a deep-drawn sleeve;

FIG. **15** shows a schematic vertical section through the contact element of the cell connector depicted in FIG. **14**, along the line **15-15** in FIG. **14**;

FIG. **16** shows a schematic section through a contact element which is in the form of a sleeve, and an associated terminal element of a voltage tapping line in a fifth embodiment of a cell connector;

FIG. **17** shows a schematic section through a contact element which is in the form of a sleeve, and a terminal element of a voltage tapping line which is likewise in the form of sleeve in an unconnected state of the contact element and the terminal element, in a sixth embodiment of a cell connector;

FIG. **18** shows a schematic section through the contact element and the terminal element depicted in FIG. **17** in the connected state of the contact element and the terminal element; and

FIG. **19** shows a schematic section through a contact element which is in the form of a sleeve in a seventh embodiment of a cell connector.

Similar or functionally equivalent elements are provided with the same reference symbols in each of the Figures.

DETAILED DESCRIPTION OF THE INVENTION

An electro-chemical device designated as a whole by **100** comprises, for example, a plurality of (not illustrated) electro-chemical modules each of which comprises a plurality, eight or twelve in each for example, electro-chemical cells **102** which are each accommodated in a seating of a (not illustrated) holding device of the module.

In particular, such a holding device can be in the form of a heat sink which is in heat conducting contact with the electro-chemical cells accommodated therein in order to extract the heat produced by the electro-chemical cells **102** when the electro-chemical device **100** is in operation.

The electro-chemical cells **102** are arranged and oriented in the surrounding holding device in such a manner that the axial directions **104** of the electro-chemical cells **102**, which extend in parallel with the central longitudinal axes **106** of the electro-chemical cells **102**, are oriented such as to be substantially parallel to each other.

Thereby, each of the electro-chemical cells **102** extends in the respective axial direction **104** from a front cell terminal **108** up to a (not illustrated) rear cell terminal, each of the cell terminals forming a positive pole or a negative pole of the respective electro-chemical cell **102**.

The central longitudinal axes **106** of the electro-chemical cells **102** are thereby simultaneously central longitudinal axes of the cell terminals **108** of the respective electro-chemical cells **102**.

Within a module, the mutually neighboring electro-chemical cells **102** are oriented relative to each other in such a manner that the cell terminals of two neighboring cells **102***a*, **102***b* arranged on the same side of the module exhibit mutually opposite polarities.

Thus, for example, in the cell assembly illustrated in FIG. **1**, the front cell terminal **108***a* of the electro-chemical cell **102***a* forms a negative pole of the corresponding electro-chemical cell **102***a*, whilst the front cell terminal **108***b* of the electro-chemical cell **102***b* neighboring thereon in the connecting direction **110** of the electro-chemical cell **102***a* forms a positive pole of the electro-chemical cell **102***b*.

The electro-chemical device **100** can, in particular, be in the form of an accumulator, preferably, a lithium ion accumulator of the type $LiFePO_4$ for example.

In correspondence therewith, the electro-chemical cells **102** of the electro-chemical modules can be in the form of accumulator cells, and in particular, in the form of lithium ion accumulator cells of the type $LiFePO_4$ for example.

Furthermore, each electro-chemical module comprises a plurality of cell connectors **112** by means of which the cell terminals **108** of mutually neighboring electro-chemical cells **102** of different polarity are connected to one another in an electrically conductive manner in order to connect all of the electro-chemical cells **102** of an electro-chemical module electrically in series in this manner.

Hereby, each cell connector **112** connects a first cell terminal **108***a* of negative polarity to a second cell terminal **108***b* of positive polarity of a neighboring electro-chemical cell **102**.

In order to connect all the electro-chemical cells **102** of a module electrically in series, then, apart from the front cell terminals **108** of mutually neighboring electro-chemical cells, the rear cell terminals of mutually neighboring electro-chemical cells of a module are also connected to one another by (not illustrated) cell connectors.

Each of the cell connectors **112** which respectively interconnects a first cell terminal **108***a* and a second cell terminal **108***b* in electrically conductive manner comprises a base body **114** having a first contact region **116** which, in the assembled state of the cell connector **112**, is arranged such that it neighbors a first (negative for example) cell terminal **108***a* of an electro-chemical cell **102***a*, and a second contact region **118** which, in the assembled state of the cell connector **112**, is connected to a second (positive for example) cell terminal **108***b* of another electro-chemical cell **102***b*.

The base body **114** of the cell connector **112** is preferably in the form of a stamped and bent part.

The base body **114** may be single-layered or multi-layered.

In a multi-layer implementation, a plurality of layers of the base body **114** can be integrated with one another. As an alternative or in addition thereto, provision may also be made for the plurality of layers of the base body to be manufactured separately from each other and to be connected to one another during the process of assembling the cell connector, in particular, by means of a substance-to-substance bond.

Furthermore, the cell connector **112** may comprise a contact body **120** which is manufactured separately from the base body **114** and is fixed to the side of the base body **114** facing the cell terminals **108** in the region of the first contact section **116**, preferably, by means of a substance-to-substance bond.

In particular, the contact body **120** can be connected to the base body **114** of the cell connector **112** by welding, by ultrasonic welding for example, by soldering and/or by adhesion.

The contact body **120** is preferably in the form of a stamped part.

In the assembled state of the cell connector **112**, the contact body **120** is connected to a jointing area of the base body **114** facing the contact body **120** and, in the assembled state of the electro-chemical device **100**, it is connected to one of the cell terminals **108**, to the negative first cell terminal **108***a* for example, by means of a substance-to-substance bond.

In particular, provision may be made for the contact body **120** to be connected to the cell terminal **108***a* by welding, and in particular, by laser welding.

As an alternative thereto however, provision could also be made for the cell connector **112** not to comprise a contact body **120**, but rather, for the base body **114** to be connected directly to both cell terminals **108***a*, **108***b*, especially by being welded thereto. This can be the case, in particular, where both cell terminals **108***a*, **108***b* are formed from a material that can be readily connected to the material of the base body **114**.

Furthermore, the base body **114** of the cell connector **112** comprises two voltage tapping points **138**, for example in the form of web members, which are formed in one piece manner with a respective one of the contact regions **116** or **118** and extend away therefrom.

In particular, provision may be made for the web-formed voltage tapping point **138** to comprise an initial section **140** which is connected to the respectively associated contact region **116** or **118** and which, for example, extends substantially in parallel with a longitudinal direction **146** of the cell connector **112** and comprises an end section **148** that follows onto the initial section **140** and extends substantially parallel to the transverse direction **142** of the cell connector **112** for example.

The transverse direction **142** and the longitudinal direction **146** of the cell connector **112** run perpendicularly to each other.

Hereby, the initial section **140** of the voltage tapping point **138** is preferably connected to the end section **148** of the voltage tapping point **138** by means of a curved intermediate section **150**.

The free end of the end section **148** of the voltage tapping point **138** is provided with a contact element **154** for the purposes of attaching the voltage tapping point **138** to a terminal element **188** of a voltage tapping line of the electro-chemical device **100** on a printed circuit board **190**.

In order to enable the position of the contact element **154** to be altered in a desired manner i.e. its positioning in a contact direction **156** of the cell connector **112** perpendicular to the transverse direction **142** and to the longitudinal direction **146** relative to the position of the contact regions **116** and **118**, the voltage tapping point **138**, and in particular the end section **148** thereof, can be provided with an off-set portion **158**.

The off-set portion **158** preferably extends substantially transversely, and in particular, substantially perpendicularly with respect to a longitudinal direction of the end section **148**.

Basically, in the assembled state of the electro-chemical device **100**, the off-set part **160** of the voltage tapping point **138** can be displaced with respect to the contact region **122**, towards the cell terminal **108***a* or away from the cell terminal **108***a*.

In the embodiment illustrated in the drawings, the off-set part **160** of the voltage tapping point **138** is displaced with respect to the contact regions **116** and **118**, towards the cell terminal **108***a*.

The average thickness of the material of the voltage tapping point **138** is preferably substantially the same as that of the base body **114**.

The one-piece contact body **120** preferably consists of a material that is different from the material of the base body **114** and it is preferably formed substantially entirely from a material that is different from the material of the base body **114**.

In particular, provision may be made for the contact body **120** to be made of nickel or a nickel alloy.

In operation of the electro-chemical device **100**, a difference between the longitudinal expansion of the cell connectors **112** on the one hand and a change in the spacing between the longitudinal axes **106** of the cell terminals **108***a*, **108***b* that are connected together by the cell connectors **112** on the other can occur due to differing temperatures and/or due to differing thermal coefficients of expansion of the cell connectors **112** on the one hand and of the holding device for the electro-chemical cells **102** on the other. As a result of a change in temperature, the relative positions of the cell terminals **108***a*, **108***b* interconnected by a cell connector **112** will alter in the connecting direction **110** which is oriented perpendicularly with respect to the axial direction **104** of the electro-chemical cells **102**.

The connecting direction **110** is located in a plane **180** which contains the longitudinal axes **106** of the electro-chemical cells **102***a* and **102***b* (see FIG. **3**).

Furthermore, due to differing longitudinal expansions of the electro-chemical cells **102***a*, **102***b* that are connected together by a cell connector **112**, there may occur a change in the relative positions between the interconnected cell terminals **108***a*, **108***b* along the axial direction **104** of the mutually interconnected electro-chemical cells **102***a*, **102***b*.

In order to compensate for such differences between the longitudinal expansion of the cell connector **112** on the one hand and a change in the spacing between the longitudinal axes **106** of the cell terminals **108***a*, **108***b* connected together by the cell connector **112** on the other and/or for such differences between the longitudinal expansions of a first electro-chemical cell **102***a* and a second electro-chemical cell **102***b* which are connected together by the cell connector **112**, provision may be made for the cell connector **112** to comprise a resiliently and/or plastically deformable compensation region **182** which is arranged between the first contact region **122** and the second contact region **166** of the cell connector **112** and which connects the two contact regions **122** and **166** together.

Preferably, the base body **114** of the cell connector **112** is provided with such a compensation region **182**.

In the embodiment of a cell connector **112** illustrated in the Figures, the deformable compensation region **182** has a wave-like structure, wherein the wave-like structure comprises one or more e.g. three undulations having an amplitude which is directed in parallel with the axial direction **104** of the cells **102***a*, **102***b* that are to be interconnected by the cell connector **112** and substantially perpendicularly relative to the respective contact areas at which the cell connector **112** abuts the first cell terminal **108***a* and the second cell terminal **108***b* in the assembled state. These undulations comprise a plurality, e.g. three wave peaks **184** which run transversely, preferably substantially perpendicularly, to the axial direction **104** of the electro-chemical cells **102** and transversely, preferably substantially perpendicularly, to the longitudinal direction **146** of the cell connector **112** and substantially parallel to the transverse direction **142** of the cell connector **112**, and also a plurality of wave troughs **186** which are arranged between the wave peaks **184** and run transversely, preferably substantially perpendicularly, to the axial direction **104** of the electro-chemical cells **102** and transversely, preferably substantially perpendicularly, to the longitudinal direction **146** of the cell connector **112** and substantially parallel to the transverse direction **142** of the cell connector **112**.

In the assembled state of the electro-chemical device **100**, the longitudinal direction **146** of the cell connector **112** extends substantially in parallel with the connecting direction **110**, and the transverse direction **142** of the cell connector **112** extends substantially perpendicularly with respect to the connecting direction **110**.

The wave peaks **184** project upwardly in the contact direction **156** of the cell connector **112** which is perpendicular to the contact areas of the cell connector **112** and coincides with the axial direction **104** of the electro-chemical cells **102** in the assembled state of the electro-chemical device **100**, whilst the wave troughs **186** project downwardly in the contact direction **156** (i.e. towards the cells **102** that are to be connected together).

Due to the wave-like structure of the deformable compensation region **124** of the cell connector **112**, the effect is achieved that the compensation region **124** is resiliently and/or plastically deformable in simple manner in such a way that the second contact region **118** can be displaced relative to the first contact region **116** in both the axial direction **104** of the electro-chemical cells **102** as well as in the longitudinal direction **146** of the cell connector **112** in order to compensate for the previously described differences in the relative positions of the cell terminals **108***a* and **108***b* that are to be connected together by the cell connector **112**. This can thereby prevent the occurrence of excessive mechanical stresses at the junction points between the cell connector **112** on the one hand and the first cell terminal **108***a* and also the second cell terminal **108***b* on the other.

The base body **114** of the cell connector **112** is formed from an electrically conductive metallic material consisting of aluminum or an aluminum alloy for example.

Likewise, a contact area **164** of the second cell terminal **108***b*, at which the second cell terminal **108***b* is connected to the base body **114** of the cell connector **112** by means of a substance-to-substance bond, is preferably formed from aluminum or an aluminum alloy so that a uniform substance-to-substance connection is obtained between the second cell terminal **108***b* and the base body **114** of the cell connector **112**.

Aluminum or an aluminum alloy has an oxide coating so that this material cannot be soldered without a pre-coating.

In consequence, the upper surface **192** of the base body **114** which is remote from the cell terminals **108***a* and **108***b* in the assembled state is provided with a coating consisting of a contacting material.

The contacting material is an electrically conductive material.

Preferably, the contacting material is a metallic material.

In particular, provision may be made for the contacting material to comprise nickel, silver, gold, copper and/or tin.

Provision may be made in particular for the contacting material to be a nickel alloy, a silver alloy, a gold alloy, a copper alloy or a tin alloy.

Nickel, silver, gold, copper or tin preferably form the main component of the contacting material, i.e. the component which exhibits the highest part by weight of the contacting material.

The coating **194** consisting of the contacting material extends over at least a part of the upper surface **192** of the base body, and in particular, over at least a part of the upper surface of the voltage tapping point **138**. The coating **194** of contacting material preferably extends over substantially the entire upper surface **192** of the base body **114** and in particular too, over the entire upper surface of the voltage tapping point **138**.

The contact element **154** is connected in one piece manner to an end region **198** of the end section **148** of the voltage tapping point **138** by a web member **196** which is bent at an angular extent of approximately 90° and extends along a longitudinal axis **200** that is substantially parallel to the contact direction **156** of the cell connector **112** (see especially FIG. **4**).

As can best be seen from the cross section depicted in FIG. **5**, the contact element **154** in this embodiment is substantially in the form of a cylindrical section which extends about the longitudinal axis **200** of the contact element **154** over a peripheral angular extent α of more than 270°, preferably of more than 300°, of approximately 320° for example.

The contact element **154** thus comprises a peripheral wall **202** which extends around the longitudinal axis **200** and likewise extends over a peripheral angular extent α of more than 270°, preferably of more than 300°, of approximately 320° for example, about the longitudinal axis **200** and is provided substantially in its entirety with the coating **194** consisting of the contacting material.

By contrast, the two end faces **204** of the contact element **154**, which are oriented radially relative to the longitudinal axis **200** and connect the outer surface of the contact element **154** to the inner surface of the contact element **154** close to the longitudinal axis **200** and which are spaced from one another by an angle β (β=360°−α) (taken with respect to the longitudinal axis **200**), are not provided with the coating **194** of contacting material.

These two end faces **204** may, in particular, be free separation edges of the base body **114** which result from the process of separating the base body **114** from a pre-coated starting material (in particular, by being punched out or cut out) as will be explained in yet more detail hereinafter in the course of the explanation of the production of the base body **114**.

Thus, in this embodiment of a cell connector **112**, the contact element **154** is in the form of a virtually cylindrical spigot or pin **206** which is provided with the contacting material over substantially the whole of its peripheral wall **202** and is therefore solderable to a terminal element **188** of a voltage tapping line over its entire periphery.

As is illustrated in FIG. **4**, in the assembled state of the cell connector **112**, the pin-shaped contact element **154** extends through a passage opening **208** in the printed circuit board **190** which forms the terminal element **188** in this embodiment.

The passage opening **208** has an axial direction **209** which is substantially coaxial with the longitudinal axis **200** of the contact element **154** in the assembled state of the cell connector **112**.

The contact element **154** is soldered to the terminal element **188** by means of a solder layer **210** which connects the edge of the passage opening **208** to the peripheral wall **202** of the contact element **154**.

A secure, highly-conductive electrical connection between the contact element **154** on the one hand and the terminal element **188** on the other is thereby produced.

Consequently, by means of the contact element **154**, one can obtain a reliable, operationally secure electrical connection of low contact resistance between the respectively associated contact region **116** and **118** of the cell connector **112** and the terminal element **188** of the voltage tapping line which is connected to a (not illustrated) evaluating device of the electro-chemical device **100**.

Monitoring of the individual cells of the electro-chemical device **100** can be effected by means of the evaluating device by measuring differences in the electrical potential between the contact regions **116**, **118** of the various cell connectors.

The electrical potential at the contact regions **116**, **118** of the cell connector can thereby be detected and evaluated in a particularly simple manner.

For the purposes of producing the cell connector **112** such as the one illustrated in FIGS. **1** to **5**, one proceeds as follows.

Firstly, there is provided a starting material made of a sheet-like starting material for example which comprises a base material that is provided with a coating of contacting material and consists of aluminum or an aluminum alloy for example.

Thereafter, a base body pre-form is separated out from the coated starting material by punching it out for example or by cutting it out (by means of a laser for example).

The wave peaks **184** and the wave troughs **186** of the compensation region **182** and the off-set portions **158** of the voltage tapping points **138** are formed in the base body pre-form by suitable reshaping processes, in particular, by stamping or deep-drawing processes.

A substantially rectangular extent section of the base body pre-form, which is connected in one piece manner by the narrower web member **196** to the end section **148** of the voltage tapping point **138**, is formed by a rolling process into the virtually cylindrical contact element **154** having the longitudinal axis **200**.

Subsequently, the web member **196** is bent in such a manner that the longitudinal axis **200** of the contact element **154** is aligned substantially in parallel with the contact direction **156** of the cell connector **112**.

The production of the base body **114** of the cell connector **112** is thus concluded.

The contact body **120** is likewise separated out, separately from the base body **114**, from a starting material consisting of a sheet-like starting material for example, by being punched out for example or by being cut out (by means of a laser for example).

Thereafter, the contact body **120** is connected to the base body **114**, preferably by means of a substance-to-substance bond.

This connection is preferably effected by an ultrasonic welding process.

The cell connector **112** produced from the base body **114** and the contact body **120** in such a manner is then connected, at the contact body **120** and at the second contact region **118**, to a respective cell terminal **108** of an electro-chemical cell **102**, preferably, by means of a substance-to-substance bond.

Finally, the contact element **154** of the voltage tapping point **138** of the base body **114** is connected, in particular by soldering, to the terminal element **188** of the voltage tapping line which leads to the evaluating device of the electro-chemical device **100**.

A second embodiment of a cell connector **112** that is illustrated in FIGS. **6** to **10** differs from the previously described first embodiment that is illustrated in FIGS. **1** to **5** in that the contact element **154** of the voltage tapping point **138** is not in the form of a rolled, virtually cylindrical pin **206**, but rather, is in the form of a stamped pin **212** having a polygonal cross section and in particular, an octagonal cross section (see in particular FIG. **9**).

As can best be seen from FIGS. **8** to **10**, the pin **212** comprises two main side faces **214** which are parallel to the longitudinal axis **200** of the pin **212** and substantially parallel to each other and which are provided with the coating **194** of contacting material over substantially the whole of their surface areas.

Adjoined laterally to each of the main side faces **214**, there are two beveled surfaces **216** which are likewise parallel to the longitudinal axis **200** of the contact element **154** and are inclined at an acute angle of e.g. approximately 45° to the respectively associated main side faces **214**.

The beveled surfaces **216** of the contact element **154** are also provided with the coating **194** of contacting material over substantially the whole of their surface areas.

The free lateral edges of the beveled surfaces **216** remote from the main side faces **214** are connected to the respectively opposite further beveled surface **216** by a respective secondary side face **218** of the contact element **154** which is oriented such as to be parallel to the longitudinal axis **200** of the contact element **154** and, for example, substantially perpendicular with respect to the main side faces **214** of the contact element **154**.

The adjoining side faces **218** are not provided with the coating **194** of contacting material.

The adjoining side faces **218** can, in particular, form free separation edges of the base body **114** of the cell connector **112**.

As can best be seen from the cross section through the contact element **154** depicted in FIG. **9**, the main side faces **214** and the beveled surfaces **216** of the contact element **154** form a coated part of a peripheral wall **202** of the contact element **154** which extends (in two mutually separated sections) over an overall peripheral angular extent α of more than

270°, preferably of more than 300°, of approximately 320° for example, about the longitudinal axis **200** and is provided with the coating **194** of contacting material over substantially the whole of its surface area.

The uncoated secondary side faces **218** of the contacting element together extend over a peripheral angle β (β=360°−α) about the longitudinal axis **200** of the contact element **154** and form an uncoated part of the peripheral wall **202** of the contact element **154**.

For the purposes of producing the cell connector **112** in accordance with the second embodiment, there is used a starting material which comprises a base, material, in particular, aluminum or an aluminum alloy and which is provided on both sides, i.e. on its upper surface and on its lower surface, with a coating **194** of contacting material.

After separating out the base body pre-form from the starting material having a coating on both sides, the coating **194** of contacting material initially extends over only the upper surface and the lower surface of the contact element pre-form and thus, only over a peripheral angular extent of 180° overall. Thereafter, the coated beveled surfaces **216** of the contact element **154** are produced from regions of the coated upper surface and the coated lower surface of the base body pre-form by a stamping process. Consequently, by virtue of the process of stamping these beveled surfaces **216**, the peripheral angular extent of the part of the peripheral wall **202** of the contact element **154** that is provided with the coating **194** of contacting material is increased from 180° to at least 270°, preferably to at least 300°, whilst the peripheral angular extent of the uncoated part of the peripheral wall **202** is reduced correspondingly.

Hereby, the solderable upper surface of the contact element **154** is enlarged to such an extent as to enable a secure and electrically highly-conductive solder joint to be made to the terminal element **188** of the printed circuit board **190**.

After the process of stamping the beveled surfaces **216**, the end region of the contact element **154** facing the end section **148** of the voltage tapping point **138** is bent in such a way that the longitudinal axis **200** of the end region of the contact element **154** remote from the end section **148** of the voltage tapping point **138** is aligned such as to be substantially parallel to the contact direction **156** of the cell connector **112**.

In the process of assembling the cell connector **112**, the pin shaped contact element **154** is inserted into the passage opening **208** of the terminal element **188** and then soldered to the edge of the passage opening **208** by means of a layer of solder **210**.

In all other respects, the second embodiment of a cell connector **112** that is illustrated in FIGS. **6** to **10** corresponds in regard to the construction, functioning and manner of manufacture thereof to the first embodiment that is illustrated in FIGS. **1** to **5**, and insofar, reference is made to the preceding description thereof.

A third embodiment of a cell connector **112** that is illustrated in FIGS. **11** to **13** differs from the two embodiments that are illustrated in FIGS. **1** to **10** in that the contact element **154** of the voltage tapping point **138** is not in the form of a rolled or stamped pin but rather, in the form of a deep-drawn bowl **220** having an annular flanged region **222** from which a dome-shaped region protrudes in the contact direction **156**.

The flanged region **222** of the contact element **154** is connected to the end section **148** of the voltage tapping point **138** in one piece manner.

In this embodiment, the upper surface **226** of the flanged region **222** and the outer surface **228** of the dome-shaped region **224** of the contact element **154** are provided with the coating **194** of contacting material over substantially the whole of their surface areas, whilst the lower surface **230** of the flanged region **222**, the inner surface **232** of the dome-shaped region **224** and the lateral edge **234** of the flanged region **222** are preferably uncoated.

Thus, in this embodiment, the outer surface **228** of the contact element **154** forms a peripheral wall **202** of the contact element **154** which extends over a peripheral angular extent of 360° about the longitudinal axis **200** of the contact element **154** and is provided with the coating **194** of contacting material over substantially all of its surface area.

The dome-shaped region **224** of the contact element **154** is preferably substantially rotationally symmetrical with respect to the longitudinal axis **200** in this embodiment.

For the purposes of producing the base body **114** of the cell connector **112** in this third embodiment, a starting material which is coated with the contacting material on only one side thereof is preferably used.

The base body pre-form is separated out from this starting material, by being punched out for example or by being cut out (by means of a laser for example) in such a manner that a contact element pre-form having the appearance of a substantially circular disk is obtained.

The bowl-like contact element **154** that is illustrated in FIG. **13** is formed from this disk-shaped contact element pre-form in a subsequent deep-drawing process.

In the process of assembling the cell connector **112**, the contact element **154** is introduced into the passage opening **208** of the terminal element **188** with its coated outer surface foremost, and the outer surface **228** of the dome-shaped region **224** of the contact element **154** that is coated with the contacting material is connected by a layer of solder to the edge of the passage opening **208** in order to produce the electrically conductive connection between the contact element **154** and the terminal element **188**.

In all other respects, the third embodiment of a cell connector **112** that is illustrated in FIGS. **11** to **13** corresponds in regard to the construction, functioning and manner of manufacture thereof to the first embodiment that is illustrated in FIGS. **1** to **5**, and insofar, reference is made to the preceding description thereof.

A fourth embodiment of a cell connector **112** that is illustrated in FIGS. **14** and **15** differs from the third embodiment that is illustrated in FIGS. **11** to **13** in that the contact element **154** of the voltage tapping point **138** is not in the form of a bowl **220** having a closed dome-shaped region **224**, but instead, it is in the form of a sleeve **236** which is open at both ends.

The sleeve **236** comprises an annular flanged region **222** from which a substantially hollow cylindrical region **238** of the contact element **154** protrudes in the contact direction **156**.

The upper surface **226** of the flanged region **222** and the outer surface **240** of the hollow cylindrical region **238** are provided with the coating **194** of contact material.

The outer surface **240** of the hollow cylindrical region **238** thus forms a peripheral wall **202** of the contact element **154** which extends over a peripheral angular extent of 360° about the longitudinal axis **200** of the contact element **154** and substantially the whole surface area thereof is provided with the coating **194** of contacting material.

In this embodiment however, the lower surface **230** of the flanged region **222**, the inner surface **242** of the hollow cylindrical region **238** and the lateral edge **234** of the flanged region **222** are preferably not provided with the coating **194** of contacting material.

For the purposes of producing the base body **114** of the cell connector **112** in accordance with this fourth embodiment, use is made of a starting material that is coated with the contacting material on only one side thereof.

The base body pre-form that has been separated out from this starting material, by being punched out or cut out for example, comprises an e.g. circular-disk-shaped contact element pre-form into which a passage opening has been introduced, preferably, substantially centrally thereof.

Subsequently, the sleeve-shaped contact element **154** which is illustrated in FIG. **15** is produced from the contact element pre-form provided with the passage opening by a deep-drawing process.

Thus, in this embodiment, the contact element **154** has the shape of an eyelet or a soldering land.

In the process of assembling the cell connector **112**, the contact element **154** is introduced into the passage opening **208** of the terminal element **188** with the hollow cylindrical region **238** thereof foremost, and the outer surface **240** of the hollow cylindrical region **238** provided with the coating **194** of contacting material is connected by a layer of solder to the edge of the passage opening **208** so as to produce a mechanically sound and highly conductive electrical connection between the contact element **154** and the terminal element **188** of the voltage tapping line.

In all other respects, the fourth embodiment of a cell connector **112** that is illustrated in FIGS. **14** and **15** corresponds in regard to the construction, functioning and manner of manufacture thereof to the third embodiment that is illustrated in FIGS. **11** to **13**, and insofar, reference is made to the preceding description thereof.

A fifth embodiment of a cell connector **112** that is illustrated in FIG. **16** differs from the previously described fourth embodiment that is illustrated in FIGS. **14** and **15** in that, after the introduction of the contact element **154** into the passage opening **208** of the terminal element **188** of the voltage tapping line during the process of assembling the cell connector **112**, the contact element **154** of the voltage tapping point **138** that was initially produced in the form of a sleeve **236** has been deformed in such a manner that the initially hollow cylindrical region **238** of the contact element **154** has been splayed radially outwardly onto an upper surface **244** of the terminal element **188** so that, in its fully assembled state, the contact element **154** comprises a connecting rim **246** by means of which the contact element **154** is fixed to the terminal element **188** and thus to the printed circuit board **190** not only by virtue of a substance-to-substance bond, but also in interlocking manner.

In this embodiment, the contact element **154** and the terminal element **188** are connected together using a substance-to-substance bond and in electrically conductive manner by means of a solder layer **210** which is arranged between a lower surface **248** of the connecting rim **246** and the upper surface **244** of the terminal element **188**.

In all other respects, the fifth embodiment of a cell connector **112** that is illustrated in FIG. **16** corresponds in regard to the construction, functioning and manner of manufacture thereof to the fourth embodiment that is illustrated in FIGS. **14** and **15**, and insofar, reference is made to the preceding description thereof.

A sixth embodiment of a cell connector **112** that is illustrated in FIGS. **17** and **18** differs from the fourth embodiment that is illustrated in FIGS. **14** and **15** in that the terminal element **188** of the voltage tapping line in this embodiment is not merely in the form of a passage opening **208** in the printed circuit board **190**, but instead, it is in the form of a sleeve **250** having a flanged region **252** and a hollow cylindrical region **254**.

In connection therewith, the internal diameter of the hollow cylindrical region **254** of the terminal element **188** is somewhat greater than the external diameter of the hollow cylindrical region **238** of the contact element **154** so that the hollow cylindrical region **238** of the contact element **154** can be inserted substantially completely into the terminal element **188**, as is illustrated in FIG. **18**.

In the process of assembling the cell connector **112**, the contact element **154** and the sleeve-shaped terminal element **188** are connected together by a solder layer **210** which is arranged between the upper surface **226** of the flanged region **222** and the outer surface **240** of the hollow cylindrical region **238** of the contact element **154** on the one hand and a lower surface **256** of the flanged region **252** and an inner surface **258** of the hollow cylindrical region **254** of the terminal element **188** on the other.

In order to facilitate the process of soldering the contact element **154** and the terminal element **188**, provision may also be made for the lower surface **256** of the flanged region **252** and the inner surface **258** of the hollow cylindrical region **254** of the terminal element **188** to be provided with a coating **260** consisting of a contacting material.

This contacting material may be the same as the material of the coating **194** of the contact element **154** or it could be different from this material.

In all other respects, the sixth embodiment of a cell connector **112** that is illustrated in FIGS. **17** and **18** corresponds to the fourth embodiment that is illustrated in FIGS. **14** and **15** in regard to the construction, functioning and manner of manufacture thereof, and insofar, reference is made to the preceding description thereof.

A seventh embodiment of a cell connector **112** that is illustrated in FIG. **19** differs from the embodiments that are illustrated in FIGS. **14**, **15**, **17** and **18** in that the sleeve-shaped contact element **154** is not only provided with the coating **194** of contacting material on the outer surface **240** of the hollow cylindrical region **238** and on the upper surface **226** of the flanged region **222**, but in addition, this coating is also provided on the inner surface **242** of the hollow cylindrical region **238** and on the lower surface **230** of the flanged region.

This is achieved in that, for the purposes of producing the base body **114** of the cell connector **112**, there is used a starting material wherein the base material thereof is provided with a coating **194** of contacting material on both its upper surface and on its lower surface.

This embodiment of the contact element **154** offers the advantage that the contact element can be soldered to an appropriate terminal element **188** on both the outer surface and the inner surface thereof.

In connection therewith, the terminal element **188** that is to be connected mechanically and in electrically conductive manner to the contact element **154** can be in the form of a passage opening **208** in the printed circuit board or in the form of a sleeve **250** for example.

In all other respects, the seventh embodiment of a cell connector **112** that is illustrated in FIG. **19** corresponds in regard to the construction, functioning and manner of manufacture thereof to the fourth embodiment that is illustrated in FIGS. **14** and **15**, and insofar, reference is made to the preceding description thereof.

The invention claimed is:

1. A cell connector for an electrically conductive connection of a first cell terminal of a first electro-chemical cell and a second cell terminal of a second electro-chemical cell,

comprising a voltage tapping point with a contact element for an electrically conductive connection to a terminal element of a voltage tapping line, wherein the contact element comprises a longitudinal axis and a peripheral wall extending around the longitudinal axis,

wherein the contact element comprises a base material which is at least partially pre-coated with a contacting material in an initial state and is reshaped from the initial state into a final state in such a manner that the proportion of a part of the peripheral wall that is coated with the contacting material to an overall peripheral angular extent of the peripheral wall amounts to more than 50%,

wherein the contact element is in the form of a sleeve which is coated with the contacting material on the inner periphery thereof and/or on the outer periphery thereof, and

wherein the contact element has two end faces which connect the outer periphery of the contact element to the inner periphery of the contact element and which are not coated with the coating material.

2. The cell connector in accordance with claim **1**, wherein the peripheral wall of the contact element is coated with the contacting material over a peripheral angular extent (a) of at least approximately 270° in the final state.

3. The cell connector in accordance with claim **1**, wherein the contact element is reshaped by a rolling process.

4. The cell connector in accordance with claim **1**, wherein the contact element is reshaped by a deep-drawing process.

5. The cell connector in accordance with claim **1**, wherein the contact element is reshaped by a stamping process.

6. The cell connector in accordance with claim **1**, wherein the base material comprises aluminum.

7. The cell connector in accordance with claim **1**, wherein the contacting material comprises nickel, silver, gold, copper and/or tin.

8. The cell connector in accordance with claim **1**, wherein the contact element comprises at least one free separation edge which is not coated with the contacting material.

9. The cell connector in accordance with claim **1**, wherein the peripheral wall of the contact element is coated with the contacting material to at least 50% in the final state.

10. A combination of

a cell connector for an electrically conductive connection of a first cell terminal of a first electro-chemical cell and a second cell terminal of a second electro-chemical cell, and

a terminal element of a voltage tapping line of an electro-chemical device,

the cell connector comprising a voltage tapping point with a contact element for an electrically conductive connection to the terminal element,

wherein the contact element comprises a longitudinal axis and a peripheral wall extending around the longitudinal axis,

wherein the contact element comprises a base material which is at least partially pre-coated with a contacting material in an initial state and is reshaped from the initial state into a final state in such a manner that the proportion of a part of the peripheral wall that is coated with the contacting material to an overall peripheral angular extent of the peripheral wall amounts to more than 50%,

wherein the contact element of the cell connector is connected to the terminal element by means of a substance-to-substance bond,

wherein the contact element is in the form of a sleeve which is coated with the coating material on the inner periphery thereof and/or on the outer periphery thereof; and

wherein the contact element has two end faces which connect the outer periphery of the contact element to the inner periphery of the contact element and which are not coated with the coating material.

11. The combination in accordance with claim **10**, wherein the contact element is soldered to the terminal element.

12. The combination in accordance with claim **10**, wherein the terminal element comprises a passage opening with an axial direction, wherein the longitudinal axis of the contact element is coaxial with the axial direction of the passage opening.

13. A method of manufacturing a cell connector for an electrically conductive connection of a first cell terminal of a first electro-chemical cell and a second cell terminal of a second electro-chemical cell, wherein the cell connector comprises a voltage tapping point with a contact element for an electrically conductive connection to a terminal element of a voltage tapping line, comprising the following processing steps:

providing a base material which is at least partially pre-coated with a contacting material;

separating out a cell connector pre-form from the pre-coated base material; and

reshaping the cell connector pre-form in such a manner that there is formed the contact element which, in an end state after the reshaping process, has a longitudinal axis and a peripheral wall extending over a peripheral angular extent about the longitudinal axis, wherein the proportion of a part of the peripheral wall that is coated with the contacting material to an overall peripheral angular extent of the peripheral wall amounts to more than 50% in the end state.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	: 9,385,359 B2
APPLICATION NO.	: 13/771926
DATED	: July 5, 2016
INVENTOR(S)	: Fritz et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

Item (72), the fourth inventor reads "Michael Kohnle, Huiben (DE)" and should read -- Michael Kohnle, Hülben (DE) --

Additionally, under the heading "Foreign Application Priority Data," should read:

Foreign Application Priority Data
Feb. 21, 2012 (DE)........... 10 2012 202 623.**1**

In the Claims

At Column 17, Claim 2, Line 21, reads "peripheral angular extent (a) of at" should be changed to -- peripheral angular extent (α) of at --

Signed and Sealed this
Fourteenth Day of February, 2017

Michelle K. Lee
Director of the United States Patent and Trademark Office